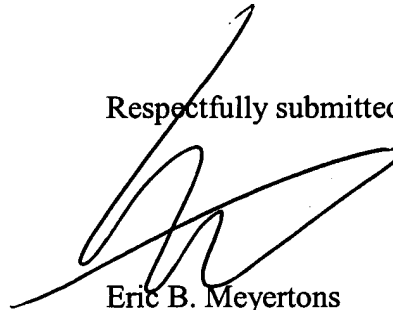


U. Conclusion

Applicant submits that all claims are in condition for allowance. Favorable reconsideration is respectfully requested.

A Fee Authorization in the amount of \$504.00 is enclosed to cover fees for the added claims. If any extension of time is required, Applicant hereby requests the appropriate extension of time. If any further fees are required, or if any fees have been overpaid, please appropriately charge or credit those fees to Conley, Rose & Tayon, P.C. Deposit Account Number 50-1505/5659-02000/EBM.

Respectfully submitted,

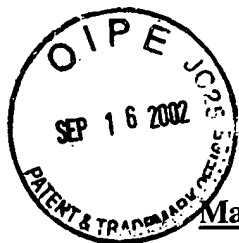


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Date: 9/12/02



Inventors: Wellington et al.
Appl. Ser. No.: 09/841,433
Atty. Dckt. No.: 5659-02000

Marked-Up Copy of the Amendments Submitted In Response To The Office Action

Mailed On June 12, 2002

In the Specification:

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On page 38, the paragraph beginning on line 14.

As used herein, "a method of treating a hydrocarbon containing formation" may be used interchangeably with "an in situ conversion process for hydrocarbons."
"Hydrocarbons" are generally defined as molecules formed primarily by carbon and hydrogen atoms~~organic material that contains carbon and hydrogen in their molecular structures~~. Hydrocarbons may also include other elements, such as, but not limited to, halogens, metallic elements, nitrogen, oxygen, and/or sulfur. Hydrocarbons may be, but are not limited to, kerogen, bitumen, pyrobitumen, and oils. Hydrocarbons may be located within or adjacent to mineral matrices within the earth. Matrices may include, but are not limited to, sedimentary rock, sands, silicilytes, carbonates, diatomites, and other porous media.

On page 64, the paragraph beginning on line 11:

As shown in FIG. 3, in addition to heat sources 100, one or more production wells ~~102-104~~ will typically be disposed within the portion of the coal formation. Formation fluids may be produced through production well 104. ~~Production well 102 may be configured such that a mixture that may include formation fluids may be produced through the production well.~~ Production well ~~102-104~~ may also include a heat source. In this manner, the formation fluids may be maintained at a selected temperature throughout production, thereby allowing more or all of the formation fluids to be produced as vapors. Therefore high temperature pumping of liquids from the production well may be reduced or substantially eliminated, which in turn decreases production costs. Providing heating at or through the production well tends to: (1) ~~prevent~~ inhibit condensation and/or refluxing of production fluid when such production fluid is moving in the production well

proximate to the overburden, (2) increase heat input into the formation, and/or (3) increase formation permeability at or proximate the production well.

In the Claims:

1883. (amended) A method of treating a hydrocarbon containing formation in situ, comprising:

providing heat from one or more ~~heat source~~heaters to at least a portion of the formation;

allowing the heat to transfer from ~~the one or more heat source~~heaters to a ~~selected section~~part of the formation;

wherein the ~~selected section~~part of the formation has been selected for heating using an atomic hydrogen to carbon ratio of at least a portion of hydrocarbons in the ~~selected section~~part of the formation, wherein at least a portion of the hydrocarbons in the ~~part of the formation~~selected section comprises an atomic hydrogen to carbon ratio greater than about 0.70, and wherein the atomic hydrogen to carbon ratio is less than about 1.65; and

producing a mixture from the formation.

1884. (amended) The method of claim 1883, wherein the one or more ~~heat source~~heaters comprise at least two ~~heat source~~heaters, and wherein controlled superposition of heat from at least ~~the two heat source~~heaters pyrolyzes at least some hydrocarbons within the ~~selected section~~part of the formation.

1885. (amended) The method of claim 1883, further comprising maintaining a temperature within the ~~part of the formation~~selected section within a pyrolysis temperature range.

1886. (amended) The method of claim 1883, wherein ~~the one or more~~ of the ~~heat source~~heaters comprise electrical heaters.

1887. (amended) The method of claim 1883, wherein ~~the one or more~~ of the heat source heaters comprise surface burners.

1888. (amended) The method of claim 1883, wherein ~~the one or more~~ of the heat source heaters comprise flameless distributed combustors.

1889. (amended) The method of claim 1883, wherein ~~the one or more~~ of the heat source heaters comprise natural distributed combustors.

1890. (amended) The method of claim 1883, further comprising controlling a pressure and a temperature within at least a majority of the ~~selected section~~ part of the formation, wherein the pressure is controlled as a function of temperature, or the temperature is controlled as a function of pressure.

1891. (amended) The method of claim 1883, wherein allowing the heat to transfer from the portion of the formation to a part of the formation comprises pyrolyzing hydrocarbons within the part of the formation, and further comprising controlling the heat such that an average heating rate of the part of the formation ~~selected section~~ is less than about 1 °C per day during pyrolysis.

1892. (amended) The method of claim 1883, wherein providing heat from ~~the one or more~~ of the heat source heaters to at least the portion of formation comprises:

heating a selected volume (V) of the hydrocarbon containing formation from the one or more of the heat source heaters, wherein the formation has an average heat capacity (Cv), and wherein the heating pyrolyzes at least some hydrocarbons within the selected volume of the formation; and

wherein heating energy/day (P_{wr}) provided to the selected volume is equal to or less than $h * V * C_v * \rho_B$, wherein ρ_B is formation bulk density, and wherein an average heating rate (h) of the selected volume is about 10 °C/day ~~wherein heating energy/day~~

~~provided to the volume is equal to or less than Pwr, wherein Pwr is calculated by the equation:~~

~~———— $Pwr = h * V * Cv * \rho B$~~

~~———— wherein Pwr is the heating energy/day, h is an average heating rate of the formation, ρB is formation bulk density, and wherein the heating rate is less than about 10 °C/day.~~

1894. (amended) The method of claim 1883, wherein providing heat from ~~the one or more of the heat source heaters~~ comprises heating the part of the formation~~selected section~~ such that a thermal conductivity of at least a portion of the part of the formation~~selected section~~ is greater than about 0.5 W/(m °C).

1906. (amended) The method of claim 1883, wherein the produced mixture comprises a non-condensable component that does not condense at 25 °C and one atmosphere absolute pressure, wherein the non-condensable component comprises hydrogen, wherein the hydrogen is greater than about 10 % by volume of the non-condensable component, and wherein the hydrogen is less than about 80 % by volume of the non-condensable component.

1909. (amended) The method of claim 1883, further comprising controlling a pressure within at least a majority of the ~~selected section~~part of the formation, wherein the controlled pressure is at least about 2.0 bar absolute.

1914. (amended) The method of claim 1883, further comprising:

providing hydrogen (H₂) to the heated part of the formation~~section~~ to hydrogenate hydrocarbons within the part of the formation~~section~~; and

heating a portion of the part of the formation~~section~~ with heat from hydrogenation.

1916. (amended) The method of claim 1883, wherein allowing the heat to transfer comprises increasing a permeability of a majority of the part of the formation~~selected section~~ to greater than about 100 millidarcy.

1917. (amended) The method of claim 1883, wherein allowing the heat to transfer comprises substantially uniformly increasing a permeability of a majority of the part of the formation~~selected section~~.

1919. (amended) The method of claim 1883, wherein producing the mixture comprises producing the mixture in a production well, and wherein at least about 7 ~~heat source~~heaters are disposed in the formation for each production well.

1920. (amended) The method of claim 1883, further comprising providing heat from three or more ~~heat source~~heaters to at least a portion of the formation, wherein three or more of the ~~heat source~~heaters are located in the formation in a unit of ~~heat source~~heaters, and wherein the unit of ~~heat source~~heaters comprises a triangular pattern.

1921. (amended) The method of claim 1883, further comprising providing heat from three or more ~~heat source~~heaters to at least a portion of the formation, wherein three or more of the ~~heat source~~heaters are located in the formation in a unit of ~~heat source~~heaters, wherein the unit of ~~heat source~~heaters comprises a triangular pattern, and wherein a plurality of the units are repeated over an area of the formation to form a repetitive pattern of units.

1922. (amended) A method of treating a hydrocarbon containing formation in situ, comprising:

providing heat from one or more ~~heat source~~heaters to a ~~selected section~~part of the formation;

allowing the heat to transfer from ~~the one or more heat source~~heaters to the ~~selected section~~part of the formation to pyrolyze hydrocarbons within the part of the formation~~selected section~~;

wherein at least some hydrocarbons within the part of the formation~~selected section~~ have an initial atomic hydrogen to carbon ratio greater than about 0.70;

wherein the initial atomic hydrogen to carbon ration is less than about 1.65; and producing a mixture from the formation.

1923. (amended) The method of claim 1922, wherein the one or more heat ~~source~~heaters comprise at least two ~~heat source~~heaters, and wherein controlled superposition of heat from at least ~~the two heat source~~heaters pyrolyzes at least some hydrocarbons within the ~~selected section~~part of the formation.

1924. (amended) The method of claim 1922, further comprising maintaining a temperature within the part of the formation~~selected section~~ within a pyrolysis temperature range.

1925. (amended) The method of claim 1922, wherein ~~the one or more~~ of the heat ~~source~~heaters comprise electrical heaters.

1926. (amended) The method of claim 1922, wherein ~~the one or more~~ of the heat ~~source~~heaters comprise surface burners.

1927. (amended) The method of claim 1922, wherein ~~the one or more~~ of the heat ~~source~~heaters comprise flameless distributed combustors.

1928. (amended) The method of claim 1922, wherein ~~the one or more~~ of the heat ~~source~~heaters comprise natural distributed combustors.

1929. (amended) The method of claim 1922, further comprising controlling a pressure and a temperature within at least a majority of the ~~selected section~~part of the formation, wherein the pressure is controlled as a function of temperature, or the temperature is controlled as a function of pressure.

1930. (amended) The method of claim 1922, further comprising controlling the heat such that an average heating rate of the part of the formation~~selected section~~ is less than about 1 °C per day during pyrolysis.

1931. (amended) The method of claim 1922, wherein providing heat from ~~the one or more of the heat source~~heaters to at least the portion of formation comprises:

heating a selected volume (V) of the hydrocarbon containing formation from ~~the one or more of the heat source~~heaters, wherein the formation has an average heat capacity (Cv), and wherein the heating pyrolyzes at least some hydrocarbons within the selected volume of the formation; and

wherein heating energy/day (Pwr) provided to the selected volume is equal to or less than $h \cdot V \cdot C_v \cdot \rho_B$, wherein ρ_B is formation bulk density, and wherein an average heating rate (h) of the selected volume is about 10 °C/day~~wherein heating energy/day provided to the volume is equal to or less than Pwr, wherein Pwr is calculated by the equation:~~

~~———— $Pwr = h \cdot V \cdot C_v \cdot \rho_B$~~

~~———— wherein Pwr is the heating energy/day, h is an average heating rate of the formation, ρ_B is formation bulk density, and wherein the heating rate is less than about 10 °C/day.~~

1933. (amended) The method of claim 1922, wherein providing heat from ~~the one or more of the heat source~~heaters comprises heating the part of the formation~~selected section~~ such that a thermal conductivity of at least a portion of the part of the formation~~selected section~~ is greater than about 0.5 W/(m °C).

1945. (amended) The method of claim 1922, wherein the produced mixture comprises a non-condensable component that does not condense at 25 °C and one atmosphere absolute pressure, wherein the non-condensable component comprises hydrogen, wherein the hydrogen is greater than about 10 % by volume of the non-condensable component, and wherein the hydrogen is less than about 80 % by volume of the non-condensable component.

1948. (amended) The method of claim 1922, further comprising controlling a pressure within at least a majority of the ~~selected-section~~part of the formation, wherein the controlled pressure is at least about 2.0 bar absolute.

1953. (amended) The method of claim 1922, further comprising:
providing hydrogen (H₂) to the heated section to hydrogenate hydrocarbons within the part of the formation~~section~~; and
heating a portion of the part of the formation~~section~~ with heat from hydrogenation.

1955. (amended) The method of claim 1922, wherein allowing the heat to transfer comprises increasing a permeability of a majority of the part of the formation~~selected section~~ to greater than about 100 millidarcy.

1956. (amended) The method of claim 1922, wherein allowing the heat to transfer comprises substantially uniformly increasing a permeability of a majority of the part of the formation~~selected-section~~.

1958. (amended) The method of claim 1922, wherein producing the mixture comprises producing the mixture in a production well, and wherein at least about 7 ~~heat source~~heaters are disposed in the formation for each production well.

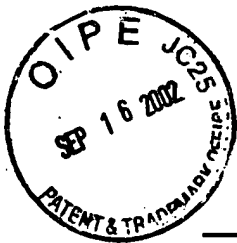
1959. (amended) The method of claim 1922, further comprising providing heat from three or more ~~heat source~~heaters to at least a portion of the formation, wherein three or more of the ~~heat source~~heaters are located in the formation in a unit of ~~heat source~~heaters, and wherein the unit of ~~heat source~~heaters comprises a triangular pattern.

1960. (amended) The method of claim 1922, further comprising providing heat from three or more ~~heat source~~heaters to at least a portion of the formation, wherein three or more of the ~~heat source~~heaters are located in the formation in a unit of ~~heat source~~heaters,

wherein the unit of ~~heat source~~heaters comprises a triangular pattern, and wherein a plurality of the units are repeated over an area of the formation to form a repetitive pattern of units.

5396. (amended) The method of claim 1919, wherein at least about 20 ~~heat source~~heaters are disposed in the formation for each production well.

5397. (amended) The method of claim 1958, wherein at least about 20 ~~heat source~~heaters are disposed in the formation for each production well.

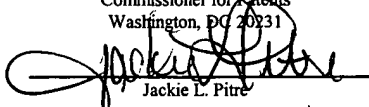


PATENT
TH1944

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No.: 09/841,433
Filing Date: April 24, 2001
Inventors: Wellington et al.
Title: IN SITU THERMAL
PROCESSING OF A
HYDROCARBON
CONTAINING FORMATION
WITH A SELECTED
HYDROGEN TO CARBON
RATIO

§ Examiner: J. J. Kreck
§ Group/Art Unit: 3673
§ Atty. Dkt. No.: 5659-02000/EBM
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<p>CERTIFICATE OF MAILING UNDER 37 C.F.R. §1.8</p> <p>DATE OF DEPOSIT: <u>9-12-02</u></p> <p>I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail on the date indicated above and is addressed to:</p> <p>Commissioner for Patents Washington, DC 20231</p> <p> Jackie L. Pitre</p>

FEE AUTHORIZATION

Commissioner for Patents
Washington, D.C. 20231

The Commissioner is hereby authorized to charge the following fees to Shell Oil Co.
Deposit Account Number 19-1800/TH1944:

18 claims additional claims in excess of 20	\$	324.00
Information Disclosure Statement submission fee.....	\$	180.00

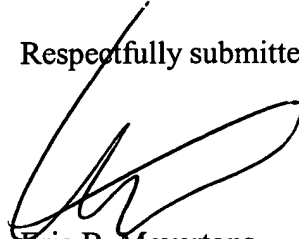
Total Amount: \$ 504.00

The Commissioner is also authorized to charge any extension fee or other fees that may
be necessary to the same account number. If the above-mentioned account is found to have
insufficient funds, the Commissioner is authorized to charge Conley, Rose & Tayon, P.C.
Deposit Account Number 50-1505/5659-02000/EBM.

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Inventors: Wellington et al.
Appl. Ser. No.: 09/841,433
Atty. Dckt. No.: 5659-02000

Respectfully submitted,



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